REMARKS

Claims 1-39 were presented and stand rejected. Claims 1-2, 6, 16-17, 24-25 and 32-33 are amended. No new matter is being added.

Response to Rejection under 35 USC §102(e)

The Examiner rejected claims 1-15 under 35 USC §102(e) as anticipated by Yau Wei Lucas Hui (U.S. Patent No. 6,654,417) ("Hui").

The claimed invention relates to single-pass variable bit rate encoding. Specifically, an encoding manager determines a buffer size for keeping track of over/underused bits generated during the encoding process. For each frame of the video sequence, the encoding manager determines the quantization value ("quant") associated with the frame and encodes the frame according to its associated quant. The quant is determined according to the buffer fullness, a base quant envelope and a base quant envelope control associated with the frame. For example, as amended, claim 1 recites:

> A method for robust single-pass variable bit rate video encoding, the method comprising:
> determining a buffer size for keeping track of over/underused bits generated during the encoding of a video sequence, the buffer size being a function of at least a target bit rate for the video sequence and a length of the video sequence;
> initializing the buffer to a default initial fullness; and
> for each frame of the video sequence, performing the following steps:
> allocating a number of bits to the frame;
> **determining a quant** with which to encode the frame, **the quant being a function of at least the buffer's fullness, a base quant envelope and a base quant envelope control associated with the frame**, wherein the base quant and the base quant envelope control are based on the type of the frame, and **the fluctuation of the base envelope is controlled by the base envelope control;**
> encoding the frame according to the determined quant; and

updating the fullness of the buffer based on any over/underused bits for the frame.

Hui does not disclose the invention of claim 1. Specifically, Hui does not disclose determining a quant for a frame to be encoded as a function of at least a buffer fullness, a base quant envelope and a base quant envelope control associated with the frame and the fluctuation of the base envelope is controlled by the base envelope control. Hui discloses a single variable bit rate encoding procedure using a target encoding quality and a bit rate determined by the complexity of the video sequence (Abstract).

Hui discloses selecting a target quality for encoded pictures before encoding a frame and compares the encoded picture quality after encoding the frame against the target quality. The target quality, QS_{target}, is defined as the target reference quantization stepsize, and the encoded picture quality, $QS_{average}$, is determined by the average value of the reference quantization stepsize (9:48-67). Based on the comparison result of QS_{target} and,$QS_{average}$, Hui adjusts the target bit rate (10:9-25).

The Examiner stated that Hui taught a scaled version of a QS_{ref} that is dependent upon a buffer fullness variable $D_{I,P,B}$ (9:25-32). However, column 9, lines 25-32 merely describes virtual buffer fullness corresponding to I-, P-, or B-pictures "after coding each MB" by the difference between the bits used by the MB and the bits allocated to the MB based on the corresponding $T_{I,P,B}$. For the sake of the argument, Hui at least needs to encode each MB and to estimate the $T_{I,P,B}$ first to obtain $D_{I,P,B}$. In contrast, the claimed invention determines a buffer size first, determines the qunant as function of the buffer fullness, the base quant envelope and the base quant envelope control at the frame level, then encodes the frame.

Claim 6 recited elements of a base quantization envelope and a base quant envelope control. These elements are now recited in claim 1. The Examiner stated that Hui taught these elements. Particularly, Hui taught the base quant envelope at column 11, lines 25-27 and the base quant envelope control at column 9, lines 34-45. However, these citations of Hui do not disclose that Hui teach or suggest determining a quant for a frame to be encoded as a function of at least a buffer fullness, a base quant envelope and a base quant envelope control associated with the frame. Rather, the column 9, lines 34-45 merely describes scaling a reference quantization step size according to the local activities of the microblock (MB). The scaling is completely determined by the local activities of a particular MB and does not concern controlling the fluctuation of the base quant envelope at frame level as claimed.

Thus, Hui does not disclose features in claim 1.

For at least these reasons claims 1, 16, 24 and 32 are patentably distinguishable over the cited reference, and the rejection should be withdrawn.

The dependent claims are also patentable over Hui, both because each depends from patentable independent claims, respectively, and because each also recites its own patentable features. Therefore, Applicants respectfully submit that claims 1-15 are not anticipated by Hui.

Response to Rejection under 35 USC §103(a)

The Examiner rejected claims 16-39 under 35 USC §103(a) as unpatentable over Hui in view of Robert N. Hurst (U.S. Patent No. 6,763,067) ("Hurst").

In the rejection of claims 16-39, the Examiner acknowledges that Hui fails to disclose a computer system to implement the features claimed in Hui, and asserts that the Hui system, "now

modified to be implemented as a computer system as shown by Hurst, has all the features of claim 16." However, Hurst does not remedy the deficiencies associated with Hui.

Hurst discloses a process to convert an exiting input compressed video bitstream into an output altered compressed video bitstream having a different bit rate and/or representing different imagery from the input bitstream (Abstract and 1:20-23). In Hurst, rate control 226 generates the Quantization Re-scale Factor (QRF) based on the comparison of input arrival margin 220 of current frame n, and output arrival margin 224 of current frame n. The QRF is used by re-encoder to scale quantization data recovered from the input bitstream for next frame, i.e., frame n+1 (8:15-28 and 2:47-52). Thus, Hurst does not disclose determine a quant as being as function of buffer fullness, a base quant envelope and a base quant envelope control and encode the **current** frame according to the determined quant as claimed.

Further, the incompatible input between Hurst's system and Hui's system prevents the implementation suggested by the Examiner from happening. More specifically, the input to Hurst's system is an exiting input compressed video bitstream while the input to Hui's system is a sequence of video pictures (Hurst at Abstract and Hui at Abstract). As known to a person of ordinary skill in the art, a sequence of video pictures to an encoder is commonly called "raw" video pictures in contrast to the "compressed" or "encoded" video stream processed by an encoder with or without rate control. To use Hui's method in combination with Hurst's system, Hurst's compressed video bitstream has to be fully decoded by Hurst's decoder 202 to generate a decoded input stream, i.e., a sequence of pictures, to be used by Hui. However, the encoding process described by Hurst at col. 5:28-59 to generate Hurst's input stream is lossy encoding as known to a person of ordinary skills in the art. Thus, Hurst's decoder 202 generates the decoded input stream, which is not raw video pictures as required by Hui's system.

The Examiner stated that Hui clearly discloses that a sequence of video pictures could come from retrieval of already compressed pictures sequence (Hui, 2:45-55). However, column 2, lines 45-55 merely discloses that VBR may be used for applications "where pictures sequences are compressed **for** storage and retrieval, for example, DVD." It does not teach or suggest that Hui's VBR algorithm is applicable to the compressed picture sequence required by Hurst.

Thus, the combination of teaching of Hui's rate control for raw input video sequence and Hurst's rate control for bitstream re-encoding does not teach or disclose the features of the claimed invention.

For at least the reasons above, Applicants submit that the pending claims 16, 24 and 32 are patentable over the cited references. Claims 17-23, 25-31 and 33-39 either directly or indirectly depend from claims 16, 24 and 32. These dependent claims also recite additional features not disclosed by the cited references. Thus, Applicants submit claims 17-23, 25-31 and 33-39 are patentably distinguishable over the cited references.

In sum, the pending claims are patentably distinguishable over the cited references and should be allowed.

The Examiner is invited to contact the attorney listed below in order to advance prosecution.

Respectfully submitted,
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